

WHAT IS CLAIMED IS:

1. A method of forming an interlayer, the method comprising:
preparing a substrate with a wiring pattern;
5 forming an insulating film on the substrate;
chemical mechanical polishing the insulating film and exposing an upper portion of
the wiring pattern;
coating the polished insulation and exposed portion of the wiring pattern with spin on
glass composition to form a film;
10 the coating using polysilazane in the spin on glass composition;
pre-baking the film in a temperature range of 50 to 350°C;
after the pre-baking, hard- baking the film in a temperature range of 300 to 500°C;
and
heat-treating the film in an oxidation atmosphere.

2. The method as claimed in claim 1, wherein the forming the insulating film
comprises forming at least one of a BPSG film, a HDP oxide film and an SOG oxide layer
from a spin on glass composition having polysilazane.

3. The method as claimed in claim 2, further comprising using at least one of a
SiO₂, CeO₂, Al₂O₃ or Mn₂O₃ based slurry in the chemical mechanical polishing.

4. The method as claimed in claim 1, wherein the coating uses a spin on glass
composition comprising about 3 to 15 weight percent of perhydropolysilazane having a
25 structure of $-(\text{SiH}_2\text{NH})_n$ (n being a positive number), an average molecular weight of about
4000 to 8000 and a molecular weight dispersion degree of about 3.0 to 4.0.

5. The method of claim 4, in which the coating further comprises using about 97
to 85 weight percent solvent in the spin on glass composition.

6. The method as claimed in claim 4, wherein the coating uses a spin on glass
composition that comprises a viscosity of about 1 to 10mPa s and shear rate of 54 to 420
(1/s).

7. The method as claimed in claim 4, in which the coating establishes the spin on glass composition with a contact angle less than 4 degrees with respect to an underlayer.

8. The method as claimed in claim 4, wherein the coating further comprises using a spin-on-glass composition that comprises at least one of the impurities from the group consisting of B, F, P, B and C.

9. The method as claimed in claim 4, wherein the coating further comprises using a spin-on-glass composition that comprises a compound having at least one of the elements from the group consisting of B, F, P, B, C and O.

10. The method as claimed in claim 4, wherein the solvent of the spin-on-glass composition comprises at least one of xylene or dibutylether.

11. The method as claimed in claim 1, wherein the heat-treating comprises establishing a temperature in a range of about 600 to 1200°C.

12. The method as claimed in claim 11, wherein the heat-treating lasts for a duration of about 10 to 120 minutes and uses an oxidation atmosphere selected from the group consisting of an oxygen atmosphere, a vapor atmosphere and a mixed atmosphere of vapor and oxygen.

13. The method as claimed in claim 1, wherein the film is formed with a thickness of about 500 to 10000Å.

14. The method as claimed in claim 1, wherein the hard-baking exposes the film to an oxidation atmosphere selected from the group consisting of an oxygen atmosphere, a vapor atmosphere and a mixed atmosphere of vapor and oxygen for a duration of about 10 to 120 minutes.

15. The method as claimed in claim 1, wherein the hard-baking exposes the film to an inert atmosphere for a duration of about 10 to 120 minutes.

16. The method as claimed in claim 15, in which the hard-baking comprises baking the substrate in a vacuum for a duration of about 10 to 120 minutes.

17. The method as claimed in claim 15, in which the hard-baking further comprises establishing a vacuum for the inert atmosphere.

18. The method as claimed in claim 1, further comprising:
determining an upper limit for the thickness of the film of spin on glass by which it may be hard-backed without crack formation;
determining if a thickness of the film exceeds the upper limit; and
decreasing a thickness of the film to below the upper limit dependent upon the thickness determination.

19. The method as claimed in claim 18, wherein the decreasing the thickness of the film uses at least one of a chemical mechanical polishing or an etch back process.

20. A method of forming an interlayer dielectric, comprising:
forming insulating material on a semiconductor substrate;
polishing the insulating material using a chemical mechanical polishing process and exposing an upper portion of a conductive pattern of the semiconductor substrate;
coating the polished insulating material and the upper portion of the conductive pattern with a spin on glass composition and forming a film, the coating using polysilazane in the spin on glass composition;
pre-baking the film at a temperature below 500°C;
determining if a thickness of the film exceeds a crack free thickness limit;
decreasing a thickness of the film dependant on the determining; and
heat-treating the film in an oxidation atmosphere.

21. A method of processing a semiconductor substrate, comprising:
forming insulating material on a semiconductor substrate having a conductive pattern and step;
chemical mechanical polishing the insulating material and exposing an upper portion of the conductive pattern;

coating the insulating material and the exposed upper portion of the conductive pattern with spin on glass composition to form a film;
using polysilazane in the spin on glass composition;
pre-baking the film in a predetermined first temperature range for a first duration;
5 hard-baking the film in a predetermined second temperature range for a second duration, the predetermined second temperature range higher than the first; and
heat-treating the film for a third duration in an oxidation atmosphere of a predetermined third temperature range, the predetermined third temperature range higher than the second.

10 22. A method of forming an interlayer dielectric film, the method comprising:
coating a spin on glass composition on a semiconductor substrate that has been formed with a conductive pattern step, the coating using polysilazane in the spin on glass composition;
5 curing the spin on glass composition to form a film;
outgassing the film, the outgassing comprises releasing silane gas; and
annealing and oxidizing the film.

20 23. The method as claimed in claim 22, in which the coating uses a spin on glass composition comprising about 20 to 30 weight percent of perhydropolysilazane and about 80 to 70 weight percent of a solvent, the perhydropolysilazane having a structure of $-(SiH_2NH)_n$ (n being a positive number), an average molecular weight of about 4000 to 8000 and a molecular weight dispersion degree of about 3.0 to 4.0.

25 24. The method as claimed in claim 23, in which the spin on glass composition further comprises a constant viscosity of about 1 to 10 (mPa s) at a shear rate of about 54 to 420 (1/s).

30 25. The method as claimed in claim 23, in which the coating establishes the spin on glass composition with a contact angle less than about 4 degrees with respect to an underlayer.

26. The method as claimed in claim 23, wherein the spin on glass composition comprises at least one impurity compound comprising at least one element of the group consisting of B, F, P, B, C and O.

27. The method as claimed in claim 23, wherein the solvent comprises at least one of xylene or dibutylether.

28. The method as claimed in claim 22, wherein the annealing uses temperatures in a range of about 600 to 1200° C.

29. The method as claimed in claim 28, in which the annealing comprises exposing the film to an oxidation atmosphere comprising at least one of oxygen and vapor for a duration of 10 to 120 minutes.

30. The method as claimed in claim 22, in which the curing comprises pre-baking the semiconductor substrate through multiple stages of different temperatures.

31. A method according to claim 30, in which the pre-baking uses a temperature range of 50 to 350°C for the multiple stages.

32. The method as claimed in claim 30, wherein the outgassing comprises hard-baking the film in a temperature range of about 300 to 500° C.

33. The method as claimed in claim 32, wherein the hard-baking comprises exposing the film to an atmosphere that comprises at least one of vapor and oxygen for a duration of about 10 to 120 minutes.

34. The method as claimed in claim 32, wherein the hard-baking is carried out for a duration of about 10 to 120 minutes in an inert atmosphere.

35. A method according to claim 34, in which the hard-baking uses nitrogen in the inert atmosphere.

36. A method according to claim 35, in which the hard-baking further comprises removing gases from a chamber to establish a vacuum for the inert atmosphere.

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